Seamless Combination of Shared and Personalized Information Presentation to Groups of Visitors in Active Museums – Research Agenda

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Abstract

The goal of the proposed research is to enhance group experiences in a museum by: (1) intelligent distribution of information across several devices, allowing members of a group to follow a public presentation while their personal interests are addressed through individual annotations on a private device, and (2) navigation support of the whole group, by finding a route through the museum that maximizes the interests of all group members and helps to mutually explore and uncover most of the relevant topics related to a cultural heritage site.

1 Introduction

Active environments are “physical spaces” that can sense and respond appropriately to the people and activities taking place within them [McCarthy, 2001]. Nowadays computers are getting smaller, cheaper, and soon will be available everywhere. As a result, the idea of "active environments" or more generally "Ambient Intelligence" [Remagnino *et al.*, 2005] is being researched extensively in various projects. Active environments pose new challenges with respect to the development of systems operating in information delivery and user support within them - there is a need to continuously monitor and support individual users as well as groups of users present in such environments. Active environments are diverse and each has its unique characteristics. In this research we center on a specific active environment as a case study. Challenges to be met will be unique to this environment but also typical of active environments in general.

The active environment under investigation is an “intelligent museum”, where visitors interact with the museum environment through mobile guides as well as other devices. In an “intelligent museum,” different devices, mobile or fixed, have to interact with a variety of services. It is not just that the number of devices in the museum cannot be easily predicted, but also that the available services may change over time. Moreover, services should be provided in a user–adapted and context–adapted way. Although a few research projects are exploring the possibilities offered by Personal Digital Assistants (PDAs) as multimedia guides (among others, [Cheverst *et al.*, 2000, Grinter *et al.*, 2002, Zancanaro *et al.*, 2003]), there have been very few attempts to investigate the possibilities to support groups of visitors in such environments and the interactions between individuals and the group.

In most museum visits, individual visitors are also parts of groups. Hence there are overall group goals and preferences to be considered in addition to the individual ones. There is a time limit to the visit; the physical distance among group members plays a role in the visit as well as the knowledge acquired by the individuals and by the whole group. Group interaction increases learning in the museum environment and as a result improves the visit experience [Leinhardt and Knutson, 2004]. This work will focus on supporting both individual and groups of visitors in a museum by providing the visit route planning for individuals while taking group goals into account. Group members receiving a group presentation that is relevant to the whole group, will be able to "deviate" at will from the group presentation and receive an individual presentation instead of the group presentation, and re-join the group again later. This deviation can be done by splitting modalities such as common video with personalized audio for instance. This and other options will be explored as part of this work.

2 Supporting Museum Group Visits

Nowadays, museums have started thinking of adapting their spaces and exhibits to the new demands of computers and interactive technologies. Therefore, the research and development of the proposed mobile infrastructure, focused on group visits, is of particular relevance and importance. Museum group visits are drawing increasing attention and supporting group visits is fast becoming an area of research interest. For example, the Sotto Voce project [Grinter *et al.*, 2002] focuses on groups of visitors interacting with a mobile museum visitor guide that supports and encourages group interaction. However, group interaction is limited to conversation of users among themselves and with the visitors’ mobile guide — this support does not extend to different locations, exhibits and time, let alone taking into account users’ individual preferences and visit history. Support for groups of visitors is one of the major requirements found in the user studies and surveys done within the HIPS project, defining requirements for a mobile museum visitor guide system [Bradbent *et al.*, 1998]. According to it, users may be walking alone around the museum, enjoying the exhibits, but they also would like to share their experience with their colleagues, comment on what they already have seen, point to interesting exhibits not yet visited, meet up again with colleagues and discuss various issues.

3 Technological Background

For the purpose of our research we plan to use a communication infrastructure called channeled multicast which was proposed by [Busetta *et al.*, 2002] as a technique for agent coordination in Ambient Intelligence scenarios. Messages sent on a channel are received by all agents tuned to it. Channeled multicast often reduces the amount of communication needed when more than two agents are involved in a task, and allows overhearing (i.e., the ability to listen to messages addressed to others). Overhearing, in turn, enables the collection of contextual information, pro-active assistance, monitoring, and in specific situations even partial recovery of message losses. The capabilities of role-based addressing and overhearing are key features in efficiently supporting implicit organizations in active environments such as our active museum. This infrastructure is currently being extended to support inter-group communication as part of the collaboration between The University of Haifa and ITC/IRST [CRI, 2005].

Tracking users in active environments in a non-intrusive manner is one of the major challenges of technological support for users in such environments. There are several positioning technologies currently in use for such purposes; however, most of them are experimental and limited. One of the well known and well experimented is IR technology, where the user carries an IR receiver that receives IR signals transmitted by emitters scattered in the environment. Since emitters are limited in range and direction (that also can be tuned) whenever a signal is received, the meaning is that the user is in the vicinity of specific emitter. The limitation of this approach is that a user must aim the receiver towards the emitter. Same limitation exists if the user carries an emitter in an environment filled with receivers. An alternative technology is based on WiFi signals. This is truly non-intrusive, but also inaccurate due to RF interference due to varying presence of users in the environment, lack of line-of sight and more – limiting the practical accuracy to cells of several square meters. Another evolving technology, RFID, is gaining interest as a simple, inexpensive and reliable technology. However its accuracy and applicability to the active museum is yet to be seen. For the design of the navigation component we plan to use a hybrid approach that integrates multiple tracking technologies and applies a Bayesian network modeling approach [Brandherm and Schwartz, 2005]. Different methods will be evaluated for the navigation component itself. Our previous research results on navigation systems for other domains (e.g. pedestrian navigation [Baus *et al.*, 2002], shopping assistants [Wasinger *et al.*, 2005] and indoor navigation [Butz *et al.*, 2001]), will be also applied to the museum domain.
For the presentation of information we intend to use PDA and projectors, which are used to either provide large scale presentations for groups or graphical overlays on or next to real exhibits. We plan to incorporate both fixed and steerable projectors into the museum setting. A steerable projector consists of a standard projector mounted on a moving yoke that can be controlled by a computer. This setting allows using any unoccluded surface in a room for projection purposes (see Figure 1).

Figure 1: A steerable projector is used to display group relevant information on or nearby exhibits. Personal devices (such as a PDA or a personal audio device) provide individual annotations.

4 Planned Research

Our approach to enhance group experiences in a museum is twofold: (1) intelligent distribution of information across several devices allows members of a group to follow a public presentation (e.g. on a large screen) while their personal interests are addressed through individual annotations on a private device (e.g. personalized audio commentaries on a PDA), and (2) navigation support of the whole group, by finding a route through the museum that maximizes the interests of all group members and helps to mutually explore and uncover most of the relevant topics related to a cultural heritage site.

For both tasks a combination of personal audio with shared video presentations projected on large screens or directly on the exhibits will be used.

4.1 Research Objectives

The research objectives are to study and define the ways for information presentation to groups in active environment by combining shared and personal modalities. The issues of group modeling, personal user models and their interaction will be studied and the possibilities for use of modalities for information presentation will be defined.
Following that, the requirements for technological support for a combination of group and personal information presentation across modalities will be defined. Specific research objectives are:
(1) To define a museum Audio and Video information presentation for groups and individuals from the technological point of view – how the technology can support and combine both individual and group information presentation across these modalities.
(2) To develop a group museum visitor's guide system that will implement the above study results using the LoudVoice agents' communication infrastructure and yet to be selected projection system.
(3) To survey, evaluate and demonstrate techniques for coherent information presentation across modalities and devices for groups of users in an active museum.
(4) Design a group-sensitive navigation component that helps a group to maximize its museum experience.

4.2 Research Plan

The research will include three phases: development of theoretical foundations, research prototype (museum visitors' guide) system development for demonstration and evaluation of the newly developed theoretical aspects, and evaluation of the novel aspects in practice in the Hecht museum (located at the University of Haifa, Israel).

Theoretical Foundations

The theoretical foundation will include definition and representation of individual and group visit goals to a museum (regarding exploring the physical and conceptual spaces as initial ideas) and, definition of ways to plan a visit supporting both individual and group goals (that may be contradicting), both in the museum physical (exhibits) and conceptual (information) spaces. This will also include the interleaving of group and individual presentation seamlessly – transfer from group to individual presentation where parts of the presentation remains individual/group – replacing the group audio with personal audio while preserving the group video, changing both audio and video from group to individual (on personal device) and back. This will include definition of when and how such transfers can take place.

Research Prototype

The research prototype system will be built in two different sites, first in Germany, for the initial stages of the research; there the initial experimentation can take place and later on in Israel, for the evaluation and final experimentation. During this phase presentations for two specific exhibitions will be prepared, providing a variety of group and individual presentation snippets that can be combined to support various scenarios of presentation.

Demonstration and Evaluation

The demonstration and evaluation of the results will be conducted in the specific setting of the ancient ship exhibition and the Phoenicians' culture exhibition at the Hecht museum in the University of Haifa [Hecht, 2005a, 2005b]. During this phase the contribution of the technology to the museum visit experience will be evaluated in user studies. These user studies will asses if users gain more from the visit when using the novel technology, compared to conventional visits and visits where personal museum visitor guides are used.

5 Expected Significance

The contributions of this research, both theoretical and practical, will define the possibilities for interleaving modalities for presentations delivery to museum group visits, it will apply the required technological support for interleaving modalities in supporting both groups and individual users in active environments in general and in cultural heritage sites such as museums, in particular.

The research is an integrated, multidisciplinary research. It is built upon recent research results of PEACH and the Haifa-ITC/IRST collaboration projects and it will extend them to support groups of visitors. The system will be demonstrated and evaluated in a specific museum, supporting personal information delivery to groups of visitors, while taking into account the group as a whole.

The research results may be applied in the future in practice in the tourism industry in general and in museums and other cultural heritage institutions in particular

Acknowledgments

This research will build upon the results of the PEACH-Project (Personal Experience with Active Cultural Heritage) a joint German-Italian research initiative [PEACH, 2005] and the closely related Italian-Israeli collaboration between ITC/IRST in Trento and the University of Haifa [CRI,2005]. Both projects deal with personalized information delivery to museum visitors.

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